Fridman, Ya. B.

POTAK, Yakov Mikhaylovich; KISHKIN, S.T., laureat Stalinskoy premii, doktor tekhnicheskikh nauk, professor, retsenzent; FRIDMAN, Ya.B., laureat Stalinskoy premii, doktor tekhnicheskikh nauk, professor, retsenzent; ZILOVA, T.K., kandidat tekhnicheskikh nauk, redaktor; SUVOROVA, I.A., redaktor; ZUDAKIN, I.M., tekhnicheskiy redaktor.

[Brittle fracture of steel and steel parts] Khrupkie razrusheniia stali i stal'nykh detalei. Moskva, Gos.izd-vo obor.promysh.,1955. 388 p. (Steel--Brittleness) (MIRA 9:4)

FRIDMAN, Ya.B.; ZILOVA, T.K.; ZHUKOVA, N.I.

Inhomogeneity of plastic deformation in the notched region and the defect sensitivity of materials. Fiz. met. i metalloved. 1 no.3:553-561 '55. (MIRA 9:6)
(Deformation (Mechanics))(Steel--Testing)

FRIDMAN, Ya. B.

1430* Local Tempering by High-Frequency Currents to Increase Structural Strength of Parts. Mestnyi otpusk T. V. Ch. dlia povysheniia konstruktivnoi prochnosti detalei. (Russian.) O. L. Bendryshev and Ia. B. Fridman. *Metallovedenie i obrabotka metallov*, 1955, no. ~~2, Aug., p. 35-42.~~

Relation of shape of area being tempered to shape of inductor and part. Various cooling arrangements; plasticity and toughness of bolts and other parts. Method is effective for improving low-tempered quenched steels. Diagrams, graphs, photographs. 14 ref.

Fridman, Ya. B.

Method of Evaluating the Sensitivity of Materials to Cracks. B. A. Drozdovskii and Ya. B. Fridman. (*Zavodskaya Laboratoriya*, 1955, 21, (5), 578- [illegible] (In Russian)). The load-testing of specimens of [illegible] generated cracks is described, the [illegible] different origin being compared. In the [illegible] the cracks were produced by repeated impact loading. Here it was found that the order of the various materials tested differs depending on whether the parameters are, on the one hand, the breaking load and the work of deformation in static bending or, on the other, the toughness and plastic properties in tension. A given material could, when cracked, fail at a lower static load than one less tough and similarly cracked. In high-strength steels the sensitivity to cracks could be especially pronounced and differ greatly from heat to heat, and for these the use of cracked test pieces is particularly advisable. For crack-sensitive steel there was a certain depth of crack which, for a given form of test-piece, led to a sharp fall in the breaking bending load. Other methods of producing cracks were: single-loading and cathodic-hydrogen cracking, but the corresponding results were less reproducible than with repeated impact-loading. All the methods led to concordant breaking-load values if the sharpness of the crack and, particularly, its direction relative to the greatest normal stress in bending are the same.—S. K.

Metal

Di VMH LFH

FRIDMAN, Ya.B.; SOBOLEV, N.D.

Estimating and increasing the strength of solids made of isotropic nonhomogeneous materials. Dokl.AN SSSR 105 no.6:1166-1169 D '55. (MLRA 9:4)

1.Moskovskiy inzhenerno-fizicheskiy institut. Predstavleno akademikom M.V.Keldyshem.

(Strength of materials)

FRIDMAN YA. B.

AL'TGAUZEN, O.N., kandidat fiziko-matematicheskikh nauk; BERNSHTEYN, M.L., kandidat tekhnicheskikh nauk; BLANTER, M.Ye., doktor tekhnicheskikh nauk; BOKSHTEYN, S.Z., doktor tekhnicheskikh nauk; BOLKHOVITINOVA, Ye.N., kandidat tekhnicheskikh nauk; BORZDYKA, A.M., doktor tekhnicheskikh nauk; BUNIN, K.P., doktor tekhnicheskikh nauk; VINOGRAD, M.I., kandidat tekhnicheskikh nauk; VOLOVIK, B.Ye., doktor tekhnicheskikh nauk [deceased]; GAMOV, M.I., inzhener; GELLER, Yu.A., doktor tekhnicheskikh nauk; GORELIK, S.S., kandidat tekhnicheskikh nauk; GOL'DENBERG, A.A., kandidat tekhnicheskikh nauk; GOTLIB, L.I., kandidat tekhnicheskikh nauk; GRIGOROVICH, V.K., kandidat tekhnicheskikh nauk; GULYAYEV, B.B., doktor tekhnicheskikh nauk; DOVGALEVSKIY, Ya.M., kandidat tekhnicheskikh nauk; DUDOVTSEV, P.A., kandidat tekhnicheskikh nauk; KIDIN, I.N., doktor tekhnicheskikh nauk; KIPNIS, S.Kh., inzhener; KORITSKIY, V.G., kandidat tekhnicheskikh nauk; LANDA, A.F., doktor tekhnicheskikh nauk; LEYKIN, I.M., kandidat tekhnicheskikh nauk; LIVSHITS, L.S., kandidat tekhnicheskikh nauk; L'VOV, M.A., kandidat tekhnicheskikh nauk; MALYSHEV,K.A., kandidat tekhnicheskikh nauk; MEYERSON, G.A., doktor tekhnicheskikh nauk; MINKEVICH, A.N., kandidat tekhnicheskikh nauk; MOROZ, L.S., doktor tekhnicheskikh nauk; NATANSON, A.K., kandidat tekhnicheskikh nauk; NAKHIMOV, A.M., inzhener; NAKHIMOV, D.M., kandidat tekhnicheskikh nauk; POGODIN-ALEKSEYEV, G.I., doktor tekhnicheskikh nauk; POPOVA, N.M., kandidat tekhnicheskikh nauk; POPOV, A.A., kandidat tekhnicheskikh nauk; RAKHSHTADT, A.G., kandidat tekhnicheskikh nauk; ROGEL'BERG, I.L., kandidat tekhnicheskikh nauk;

(Continued on next card)

AL'TGAUZEN, O.N.---- (continued) Card 2.

SADOVSKIY, V.D., doktor tekhnicheskikh nauk; SALTYKOV, S.A., inzhener; SOBOLEV, N.D., kandidat tekhnicheskikh nauk; SOLODIKHIN, A.G., kandidat tekhnicheskikh nauk; UMANSKIY, Ya.S., kandidat tekhnicheskikh nauk; UTEVSKIY, L.M., kandidat tekhnicheskikh nauk; FRIDMAN, Ya.B., doktor tekhnicheskikh nauk; KHIMYSHIN, F.F., kandidat tekhnicheskikh nauk; KHRUSHCHEV, M.M., doktor tekhnicheskikh nauk; CHERNASHKIN, V.G., kandidat tekhnicheskikh nauk; SHAPIRO, M.M., inzhener; SHKOL'NIK, L.M., kandidat tekhnicheskikh nauk; SHRAYBER, D.S., kandidat tekhnicheskikh nauk; SHCHAPOV, N.P., doktor tekhnicheskikh nauk; GUDTSOV, N.T., akademik, redaktor; GORODIN, A.M. redaktor izdatel'stva; VAYNSHTEYN, Ye.B., tekhnicheskiy redaktor

[Physical metallurgy and the heat treatment of steel and iron; a reference book] Metallovedenie i termicheskaia obrabotka stali i chuguna; spravochnik. Pod red. N.T.Gudtsova, M.L.Bernshteina, A.G. Rakhshtadta. Moskva, Gos. nauchno-tekhn. izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1956. 1204 p. (MLRA 9:9)

1. Chlen -korrespondent Akademii nauk USSR (for Bunin)
(Steel--Heat treatment) (Iron--Heat treatment)
(Physical metallurgy)

FRIDMAN, YA. B.

124-1957-10-12212

Translation from: Referativnyy zhurnal, Mekhanika, 1957, Nr 10, p 138 (USSR)

AUTHOR: Fridman, Ya. B.

TITLE: Some Results of Studies on the Characteristics of the Failure of Materials (Nekotoryye rezul'taty izucheniya kharacteristik razrusheniya materialov)

PERIODICAL: V sb.: Sovrem. metody ispytaniy materialov v mashinostroyenii. Moscow, Mashgiz, 1956, pp 5-38

ABSTRACT: A review of results is presented of work done by the Author and other investigators on the comportment of materials at the point of failure. The following problems were examined: The effect of time, the local averaged evaluation of the mechanical properties of the materials, consideration of the anisotropy of the materials, their sensitivity to notches, defects and cracks, and their fatigue strength under non-constant loadings. It is pointed out that, contrary to general belief, the occurrence of creep and slow failure in structural steel is possible even at room temperature. The A. presents his hypothetical diagram of the relative structural non-uniformity, the substance of which is reduced to a consideration of the relationship between the

Card 1/2

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Mechanical Tests with Variable [illegible]

[illegible]

[illegible] into account the plastic [illegible] the test piece. The effect [illegible] various conditions are [illegible] affecting the diagram of deformation [illegible]

FRIDMAN, Ya. B.

5

16475* (Russian.) Method of Evaluating the Tendency of Materials to Delayed Failure. Metodika otsenki sklonnosti materialov k zamedlennomu razrusheniiu. T. K. Zilova, N. [illegible] and Ya. B. Fridman. Zavodskaia Laboratoriia [illegible]

[illegible] methods of testing [illegible]

Fridman, Ya. B.

USSR/ Physics - Technical physics

Card 1/1 Pub. 22 - 23/54

Authors : Fridman, Ya. B.

Title : Diagram of relative structural inhomogeneity of materials

Periodical : Dok. AN SSSR 106/2, 258-260, Jan 11, 1956

Abstract : A description is presented of a diagram constructed for the purpose of helping in the study of the effect of structural inhomogeneity of materials on mechanical properties and deformations of the latter. Fifteen references: 14 USSR, and 1 USA (1947-1954). Diagrams; table; graph.

Institution : Moscow Engineering Physical Institute

Presented by: Academician G. V. Kurdyumov, February 21, 1955

FRIDMAN, Ya.B.; SOBOLEV, N.D.

On methods of estimating and increasing the strength of bodies made of anisotropic materials. Dokl.AN SSSR 106 no.4:611-613 F '56. (MLRA 9:6)

1.Moskovskiy inzhenerno-fizicheskiy institut. Predstavleno akademikom M.V.Keldyshem.
(Strength of materials) (Elasticity) (Anisotropy)

FRIDMAN, Ya. B. and REBINDER, P. A.

"On the General Rule of the Deformation and Decay of Different Solid and Liquid Bodies in Rock," paper presented at the First All-Union Conference on Tectonophysics, Moscow, 29 January through 5 February 1957.

Institute of Physical Chemistry, Academy of Sciences USSR

Sum 1563

FRIDMAN, YA. B

126-3-10/34

AUTHORS: Zilova, T. K., Demina, N. I. and Fridman, Ya. B.

TITLE: Study of the non-uniformity of the plastic deformation during torsion by the method of rolled-in grid network. (Izucheniye neodnorodnosti plasticheskoy deformatsii pri kruchenii metodom nakatannykh setok).

PERIODICAL: "Fizika Metallov i Metallovedeniye" (Physics of Metals and Metallurgy), 1957, Vol.4, No.3, pp. 455-469 (U.S.S.R.)

ABSTRACT: Yakutovich, M. V. and his team revealed certain features of torsion testing of materials which were previously not taken into consideration, namely, the non-uniformity of the plastic deformation along the specimen, the high sensitivity of the state of the surface and the presence of microcracks (1-4). The aim of the here described investigations was to elucidate the influence on the test results for steels after hardening and tempering of the following: the non-uniform distribution of the deformation along the specimen during torsion on the final characteristics of the mechanical properties of the material obtained for this type of investigation; the surface quality on these characteristics; the super-position of the process of fracture on the distribution of the local plastic deformations during torsion; necessity

Card 1/5

126-3-10/34

Study of the non-uniformity of the plastic deformation during torsion by the method of rolled-in grid network. (Cont.)

photo reproduced in Fig.7. Table 5 gives a comparison of the average with the local plasticity measured during torsion tests. In Table 6 the plasticity of the material in tensile tests and in torsion tests is compared for ground as well as for polished specimens. On the basis of the results it is concluded that for steel specimens with a low modulus of plasticity the process of deformation is practically uniform along the entire length (tempering at 550 C); if tempered at low temperatures (350 and 220 C), intensive hardening occurs during plastic deformation, the development of the deformation is non-uniform and practically has the character either of a "travelling" deformation, which gradually propagates along the specimen, or it is concentrated as a result of presence of stress concentrators; the non-uniform distribution of deformation is due to non-uniform resistance of the transverse cross sections brought about by non-uniformity of the macro- and micro-geometry of the specimen, non-uniformity of the structure of the material in the body of the specimen, etc; the character of the non-uniformity of propagation of the deformation depends on the surface state of the specimen; the state of the surface affects appreciably the ductility of the specimens; for polished specimens it is two to five times as

Card 3/5

126-3-10/34

Study of the non-uniformity of the plastic deformation during torsion by the method of rolled-in grid network.(Cont.)

Card 5/5 There are 9 figures, 6 tables and 9 references, all of which are Slavic.

SUBMITTED: June 27, 1956 and after revision July 12, 1956.

AVAILABLE: Library of Congress

(Composition of the Steel 40XHMA: in %, 0.36-0.44 C, 0.17-0.37 Si, 0.50-0.80 Mn, 0.60-0.90 Cr, 1.25-1.75 Ni, 0.15-0.25 Mo, max 0.030 S, 0.035 P, 0.25 Cu)

Procedure for Studying the Strength of Drills of Very Small Diameter

drills for static torsion, principles of the device for bend tests, graphs showing ratios of tangential stress, deformation of drill, ratios of crushing loads to diameter and length and degrees of bending.

ASSOCIATION: Moscow Engineering-Physics Institut (Moskovskiy inzhenerno-fizicheskiy institut)

PRESENTED BY:

SUBMITTED:

AVAILABLE:

Card 2/2

32-10-31/32

Comments

of (microscopical) 2nd degree in the zones of micro-grains. c) The deformation and detraction of 1st degree (microscopical) in the zones which corresond to the dimensions of the structural elements, or which are located higher. The theoretical conclusions in this case change according to the locality: the cracks of 3rd degree can be revisible, but those of 2nd and 3rd degree are not revisible. According to the criteria of the 2nd degree, the material can already be in state of destruction, but according to the criteria of the 1st degree it can still be in an elastic or plastic state. The conditions for various degrees can therefore be different. In this case it is necessary to apply the highest developed methods of investigation (microdefectoscopy, electron microscopy, autor-adiography, etc.). The investigation of fractional structure reflects the conditions of destruction, and is therefore of greatest importance. B) Two contradictory opinions with respect to the kinetics of the process of destruction result: Process of evolution (slow) and discreet (sudden). Both from the same process should, however, be equally treated. Energetic rules governing the deformation and destruction are often otherwise treatedthan the ratio force deformation, though the power supply of elasticity can be included into the ratio of power.

Card 2/3

32-10-31/32

Comments

Therefore the treatment of deformation-and destruction processes can also be carried out according to "slightly inert" methods (such as oscillographic, cinematographic, etc.). Concluding his report, the author states that there are still many similar interesting problems which should be dealt with by the scientists of works-laboratories, and research institutes in the very near future.

ASSOCIATION: Moscow Physics and Engineering Institute (Moskovskiy inzhenerno-fizicheskiy institut)

AVAILABLE: Library of Congress

1. Science-USSR-Progress 2. Metallurgy 3. Electron microscopy

Card 3/3

FRIDMAN, Ya.B., prof., doktor tekhn.nauk; MOROZOV, Ye.M., kand.tekhn. nauk

Calculating mechanical properties of bimetals. Nauch.dokl.vys. shkoly; mash.i prib. no.1:152-163 '58. (MIRA 12:1)

1. Predstavleno kafedroy "Soprotivleniye materialov" Moskovskogo inzhenerno-fizicheskogo instituta.
(Laminated metals)

MOROZOV, Ye.M., kand.tekhn.nauk; FRIDMAN, Ya.B., doktor tekhn.nauk

Calculating the brittle-breakdown resistance of a disk stretched in all directions. Nauch.dokl.vys.shkoly; mash.i prib. no.2: 29-32 '58. (MIRA 12:10)

1. Predstavleno kafedroy "Soprotivleniye materialov" Moskovskogo inzhenerno-fizicheskogo instituta.
(Strength of materials)

FRIDMAN, Ya.B.; MOROZOV, Ye.M.

Approximate evaluation of concentrated stresses in composite specimens. Nauch.dokl.vys.shkoly; mash.i prib. no.4:82-85 '58. (MIRA 12:5)

1. Stat'ya predstavlena Moskovskim inzhenerno-fizicheskim institutom. (Strains and stresses)

SOV/129-58-12-1/12

AUTHORS: Fridman, Ya.B., Doctor of Technical Sciences and Konoplenko, V.P., Candidate of Technical Sciences

TITLE: Mechanical Properties of Tool Steels (Mekhanicheskiye svoystva instrumental'nykh staley)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 12, pp 1 - 9 (USSR)

ABSTRACT: The aim of this investigation was the development of methods of strength testing of low-temperature tempered tool steel and to study their mechanical properties in the case of static and alternating loads. The mechanical properties were studied for specimens of the steels U12, 9KhS, R9 and R18, chemical analyses of which are given in Table 1, p 2. The specimens were manufactured with a machining addition of 0.5 to 1 mm,which was removed after heat treatments carried out in accordance with regimes usually used for tools, details of which are entered for each steel in Table 2. Much attention was paid to obtaining the necessary uniformity of the structure of the cross-section. In Figure 2, a sketch is reproduced showing the shape and size of the specimens used for tensile tests. The authors investigated the strength properties (the obtained results are entered in

Card1/3

Mechanical Properties of Tool Steels SOV/129-58-12-1/12

Tables 3 and 4), the anisotropy of the strength properties as well as the fatigue strength of the above enumerated tool steels. On the basis of the obtained results, the following conclusions are arrived at: use of wire strain gauges enables extending the range of measuring the deformation of high-hardness steels right up to the fracture of such steels; the normal modulus of elasticity of the steel R9 is not the same in tension as it is in compression and this explains partly the fact that the strength of this steel is higher in bending than it is in tension; in tension as well as in bending, the fracture of high-hardness tool steels takes place without macroplastic deformation in the elastic range, without reaching the yield point, whilst fracture in the case of compression and torsion stresses is preceded by plastic deformation; the anisotropy of the mechanical properties manifested itself in the investigated steels by differing values of the strength and ductility and also in the fact that the appearance of the fracture differed; the size of

Card2/3

SOV/129-58-12-4/12

Mechanical Properties of Tool Steels

the specimen did not appear to have any influence on the strength for changes of the diameter between 1 and 8 mm; diagrams of the ultimate strength were plotted and the ultimate strength values were determined for the steels U12, 9KhS and R9.
There are 6 figures, 4 tables and 6 Soviet references.

ASSOCIATION: Moskovskiy inzhenerno-fizicheskiy institut (Moscow Engineering-physics Institute)

Card 3/3

85765

S/137/60/000/009/026/029
A006/A001

On the Crack Sensitivity of Metals

170 kg/mm^2 and by a factor of 4 for steel with σ_b equal to 115 kg/mm^2, in comparison to a specimen with a notch of 1 mm radius, tested at room temperature. A higher deformation speed raised from 1.2 mm/min (static) to 3 . 10^5 mm/min (impact) at room temperature increases the value of the conditional rupture stress of specimens with a notch radius of 1 mm, from 5 to 40% for steels subjected to either low or high tempering or to tempering in the brittle range. There are 23 references.

T.F.

Translator's note: This is the full translation of the original Russian abstract.

Card 2/2

FRIDMAN, Ya. B.

PHASE I BOOK EXPLOITATION SOV/3416

Akademiya nauk SSSR. Institut mashinovedeniya

Voprosy prochnosti materialov i konstruktsiy (Problems of Strength of Materials and Structures) Moscow, 1959. 399 p. Errata slip inserted. 3,200 copies printed.

Resp. Ed.: D. N. Reshetov, Professor, Doctor of Technical Sciences; Ed. of Publishing House: G. B. Gorshkov; Tech. Ed.: S. T. Shikin.

PURPOSE: This book is intended for engineers and scientists concerned with the problems of the strength of materials and construction.

COVERAGE: The book contains 28 articles on the strength of materials in general and of machine construction in particular. This collection was prepared under the direction of the Institute of Mechanical Engineering of the AS USSR in honor of Sergey Vladimirovich Serensen, one of the founders and directors of the national school of strength of materials, who recently completed 30 years of scientific activity. The preface gives a short sketch of his life and professional activities. The collection is divided into two parts. The first part contains 13 articles on general problems of strength and the strength of machine construction materials. The second part contains 15 articles on dynamics and calculation of strength and rigidity. There are references at the end of each article.

13

FRIDMAN, YA.B.

P.2

25(6) PHASE I BOOK EXPLOITATION SOV/3075

Defektoskopiya metallov; sbornik statey (Flaw Detection in Metals; Collection of Articles) Moscow, Oborongiz, 1959. 458 p. Errata slip inserted. 4,550 copies printed.

Ed.: D.S. Shrayber, Candidate of Technical Sciences; Ed.: M.S. Lagovskaya; Tech. Ed.: V.P. Rozhin; Managing Ed.: A.S. Zaymovskaya, Engineer.

PURPOSE: This book is intended for engineers and technicians in the field of nondestructive inspection and testing of metals.

COVERAGE: This collection of articles deals with methods of nondestructive inspection and testing of metals. Results of investigations conducted at scientific research institutes and plants of magnetic, electrical, X-ray, ultrasonic, and fluorescent-penetrant methods of flaw detection are described. Detailed descriptions of flaw-detection methods and equipment are presented. Data are given on the status of the development of flaw-detection methods in non-Soviet countries. No personalities are mentioned. References follow several of the articles.

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SOV/3075

Flaw Detection (Cont.)

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VK/jb
2-24-60

Card 5/5

21(0) SOV/89-6-4-23/27

AUTHORS: Semenov, V. F., Fridman, Ya. B.

TITLE: Atomic Technology at the World Exhibition 1958 in Brussels (Atomnaya tekhnika na Vsemirnoy vystavke 1958 g. v Bryussele)

PERIODICAL: Atomnaya energiya, 1959, Vol 6, Nr 4, pp 493-494 (USSR)

ABSTRACT: The most important exhibits to be seen in the pavilions of Great Britain, the United States, Switzerland, Norway, Portugal, Belgium, Western Germany, and Holland are listed. In the Soviet pavilion such exhibits were, above, all, shown as demonstrated the success attained by the USSR in the field of the peaceful uses of atomic energy. They included the models of the first Soviet atomic power plant, the 420 Mw atomic power plant under construction (water-moderated and water-cooled reactor), of the experimental fast reactor, and the reactor-driven ice-breaker "Lenin". A composite photograph picture shows in what manner the Soviet Scientists participate in the international exchange of experience and contribute towards promoting the peaceful uses of atomic energy. At the exhibition also the model of a 200 kw research reactor and of a cyclotron with 1200 mm pole shoe diameter is on show. The Ob"yedinennyy institut yadernykh issledovaniy

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SOV/89-6-4-23/27

Atomic Technology at the World Exhibition 1958 in Brussels

(Joint Institute of Nuclear Research) exhibited a model of the 10 Bev synchrophasotron. Two exhibits were awarded the Grand Prix. In the Czechoslovakian pavilion a model of the 150 Mw atomic power plant, which is being built with Soviet aid, is on show. By means of this plant it will be possible to save 50,000 waggons of coal per year. The atomic power plant is able to supply a city of more than a million inhabitants with electric energy. The first Czechoslovakian research reactor was shown both in form of photographs and by a model. A model is also on show of a 15 Mev betatron which is intended to be used for medical purposes as well as for the testing of material.

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instruments. The set is provided with a loop oscillograph MPO-2, the dynamometric spring represents a series of foil springs (according to GOST 3057-54), and AMG-10 was used as working liquid. The cells were calibrated (for the purpose of measuring the axial load of the specimen) by means of the IM4A test plant. The oscillograms obtained were measured by means of a BMI microscope. The sample stress was measured by means of tension indicators. The latter consist of the ICh indicator, a small elastic U beam of beryllium bronze and "resistance cells" of the DK-10 or DK-25 type. It was stated that the influence of elasticity is determined by the kinetics of the change in the load force. Some further observations were made with the D16T alloy and some 30 KhGSNA steel specimens. There are 9 figures, 3 tables, and 9 references, 6 of which are Soviet.

SOV/32-25-3-26/62

25(6)

AUTHORS: Drozdovskiy, B. A., Fridman, Ya. B.

TITLE: Methods of Determining the Sensitivity of Materials to Crack Formation in Impact Bending Tests (Metodika otsenki chuvstvitel'nosti materialov k treshchinam pri udarnom izgibe)

PERIODICAL: Zavodskaya Laboratoriya, 1959, Vol 25, Nr 3, pp 320-328 (USSR)

ABSTRACT: The tendency of steel towards rupture as a consequence of brittleness has been more and more frequently determined by the resistance against crack formation (Refs 1-7). In a previous paper (Ref 13) a test of this kind was proposed for highly resistant steels and it was found that in many cases better results were obtained by indentations R = 1 mm (e.g. with steel 30KhGSNA) than by samples according to Menazhe In the case under discussion the results of investigations of the form of the sample for impact tests are given (Fig 1) (Table 1). Among others, the steels 30KhGSNA and 12Kh5MA with cracks of the type V, U, and F were used. Static tests were carried out on the machine IM4-A and impact bending tests on a 30 kgm-ram MK-30. The tests took place at various temperatures. Tests with crack-containing samples showed that an increase of the sample width

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SOV/32-25-3-26/62

Methods of Determining the Sensitivity of Materials to Crack Formation in Impact Bending Tests

and an impact test at lower temperatures can render the test more sensitive to states of brittleness. It is recommended to apply the impact bending test with a crack of cyclic overcharge to sample cross sections according to Menazhe, the crack being obtained by the use of a resonance vibrator (Ref 14). The test is evaluated according to the tensile strength (a_{crack}) per cross section, expressed in kilogram meters/cm^2. A table with ten types of steel and their chemical composition (Table 3) and a comparative table (Table 4) with 22 types of steel and data obtained from samples are given. It was found that by the tests mentioned above more accurate and extensive data on the state of brittleness of steels can be obtained than by the standard methods. There are 10 figures, 4 tables, and 16 references, 6 of which are Soviet.

Card 2/2

FRIDMAN, YA. B.

28(5) SOV/32-25-7-50/50

AUTHORS: Davidenkov, N. N. Academician of the AS USSR, Vitman, F. F. Professor, Doctor of Physical and Mathematical Sciences, Glikman, L. A. Professor, Doctor of Technical Sciences, Fridman, Ya. B. Professor, Doctor of Technical Sciences, Mirolyubov, I. N. Candidate of Technical Sciences, Razov, I. A. Junior Scientific Collaborator

TITLE: Yevgeniy Mikhaylovich Shevandin (Yevgeniy Mikhaylovich Shevandin)

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 7, p 896 (USSR)

ABSTRACT: This is an obituary written on the occasion of the death of the scientist mentioned in the title. Shevandin was one of the leading scientists in the field of material mechanics; he became famous for his investigations of the nature of destruction by brittleness and the phenomena of destruction by brittleness of metals at low temperatures carried out at the Fiziko-tekhnicheskiy institut (Physical and Technical Institute). After 1945 the deceased dealt with the problems of cold-shortness of ferrous metals which are of great importance in ship-building. Ye. M. Shevandin published two manuals on the mechanical properties of metals as well as

Card 1/2

SOV/32-25-7-50/50

Yevgeniy Mikhaylovich Shevandin

more than 50 original papers. His monograph "Tendency of Low-alloy Steels Towards Brittleness" was published in 1953.

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28 (5)

AUTHORS: Volodina, T. A., Gordeyeva, T. A., Fridman, Ya. B.

SOV/32-25-8-29/44

TITLE: Methodology of Investigation of the Microgeometry of the Surfaces of Fractures

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 8, pp 984-989 (USSR)

ABSTRACT: Assuming that the height of unevenness on fracture surfaces (F) increases under same conditions with the increase of the velocity of spreading of the cracks (C) one can apply visual, fractographic and similar methods for clarification of the destruction kinetics. The profilogram of the (F) was obtained in the present case with an optic-mechanical profilograph IZP-5 (Ref) at a 500x enlargement in vertical direction (Fig 1) of the profile and in 50x enlargement in horizontal direction, thus the unevenness could be measured in a height of 2-240 μ. To accelerate the measuring a special device was developed (Fig 2) in collaboration with N. V. Ryazanov, V. M. Markochev and Yu. A. Bulanov. The device consists of a measuring dial and a counter. They investigated (F) on samples of steel 30KhGSNA, 40KhNMA and a highly resistant experimental steel A, applying varying kinds of stresses and sample shapes and the samples were subjected to thermal treatment. The varicus

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Methodology of Investigation of the Microgeometry of the Surfaces of Fractures SOV/32-25-8-29/44

character of the changes of the unevenness along the (F) is apparently caused by the property of the material to "inhibit" the spreading of the (C). The efficiency of this "inhibiting" depends on the properties of the material, the magnitude of tensions, the kind of stress and other factors. The experiments proved that the steel 30KhGSNA has a higher "inhibiting" capacity (C) than steel A. It was established that in several cases the character of the change of the unevenness along the (F) was determined by the level of the primary tension and the steepest increase of unevenness was observed at an increase of the stress at a high tension level. The measurings of the height of the unevennesses of (F) after repeated static and impact-bending tests permits a qualitative evaluation of the conditions of destruction and the change in one of the following factors: condition of the material, the magnitude of the repeated stress, the character of the stress and the presence of a tension-concentrator on the test-surface. There are 8 figures and 2 Soviet references.

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28 (5) SOV/32-25-8-31/44

AUTHORS: Fridman, Ya. B., Zaytsev, A. M.

TITLE: Cause for the Formation of Fatigue Lines on Fracture Surfaces

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 8, pp 992-995 (USSR)

ABSTRACT: The surfaces of fatigue fractures (FF) often show fatigue cracks (FC) which proceed in a staggered wave shape radially from the center of the fracture (F). The causes of the origin of these (FC) are explained in different ways (Refs 1 - 8). Special mention is made of R. S. Nikolayev (Ref 8) and Thum (Ref 1). The present paper tries to explain this question, and the origin of other characteristics of (F) and recommends some methods for the analysis of (FC). The authors tested flat samples (4 x 24 mm) of 40KhNMA and 30KhGSA steels, aluminum, copper, larger-sized samples of flat, disk or T-shaped steel 40KhNMA, 38KhMYuA and steel 20. The tests were carried out in three groups which differ in the way of the developing tensions in the samples. The (F) were investigated with a binocular microscope, while the (FC) were investigated on samples not yet fractured. The experiment results proved that no (FC) develop when the samples rested or in case of a "temporary work" (decreased tension) (Fig 1). During work of the sample or in case of a brief excess strain (corres-

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ponding to the switching on of the machine) (FC) develop at the zone boundaries of various unevennesses (Fig 2). Therefore the development of such (FC) on (F) can be caused by brief cyclic excess strain as was concluded in references 5 - 7. The (FC) observed in (F) of machine components can be divided into two main groups (Fig 4), i.e. 1) (FC) at the zone boundary and of different unevennesses which occur at a sudden change of the spreading velocity of the (FC) (operation with sudden change in excess strain), and 2) the staggered (FC) which are caused by the mutual orientation of the highest degree tension-expansion and cracks. Therefore one can conclude from the type of (FC) the kind of strain. There are 4 figures and 9 references, 6 of which are Soviet.

ASSOCIATION: Gosudarstvennyy nauchno-issledovatel'skiy institut grazhdanskogo vozdushnogo flota (State Scientific Research Institute of Civilian Aviation)

14(10) SOV/20-124-6-15/55

AUTHORS: Zilova, T. K., Petrukhina, N. I., Fridman, Ya. B.

TITLE: On the Rules of the Kinetics of Deformation in Dependence on the Relaxation of the Load (O zakonomernostyakh kinetiki deformatsii v zavisimosti ot podatlivosti nagruzheniya)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 6, pp 1236 - 1239 (USSR)

ABSTRACT: The authors investigated the rules of load and deformation in the case of varying relaxation of the load system, i.e. in the case of a varying character of the time-dependence of the load force P_{load} in the case of deformation and lifting of the load in segregated system. The tests were carried out by means of the devices DRP-361 especially constructed for this purpose, in the spring—dynamometer an initial supply of elastic energy was provided. This device DRP-361 was developed by the authors in collaboration with B. A. Palkin and N. V. Ryazanov. The relaxation of the device during the tests carried out by the authors amounted to 0.7 mm/T. The results obtained were recorded by means of the loop-oscillograph MPO-2. The quantities recorded

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concerned stress on the dynamometer, stress on the sample, and extension of the sample. The experiments were carried out with smooth samples (5 mm diameter) of the alloys D16T and of KhNMA steel in the state of quenching and tempering at 200 and 550°. In the case of a relaxation of 0.7 mm/T the kinetic curves of stress on the dynamometer show a sharp downward slope, but at 2.5 mm/T this curve takes a flat course. The curves of the rate of absolute deformation are influenced by relaxation in the same way. The greater the supply of elastic energy with conditions otherwise being equal, the higher will be the rate of the deformation process when approaching fracture, and the shorter the duration of the entire process until fracture occurs. The process in all cases begins to develop with positive acceleration. The lower the degree of relaxation, the more rapidly will the process with positive acceleration go over into a process with negative acceleration, i.e. into the stage of damping. In the case of an equal initial stress, the sample will not break with a considerable decrease of force with time, but in the case of a slow decrease of force, it breaks already after the short time $\tau \approx 0.32$ sec. From the results

On the Rules of the Kinetics of Deformation in Dependence on the Relaxation of the Load

SOV/20-124-6-15/55

obtained by the present investigation the following conclusions may be drawn: The influence exercised by the supply of elastic energy (which was observed also in the case of fractures occurring during operation in practice), is essentially determined by the character of the variation of the kinetics of force in the case of disturbed or non-existing equilibrium. The greater the supply of elastic energy (with the loading force being equal), the more slowly will the loading force decrease with time if the deformation of the loading body develops further. The rules discussed in the present paper were determined in segregated systems, but it may by all means be assumed that they apply also to such cases as are subjected to an external load during the entire load process. There are 4 figures and 10 references, 7 of which are Soviet.

PRESENTED: July 24, 1958, by G. V. Kurdyumov, Academician

SUBMITTED: July 16, 1958

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[illegible]DMAN, YA. B.

report presented at the 1st All-Union Congress of Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb '60.

102. J. Dvorak (Prague): The state of stress and deformation of the turbine blades.

103. V. M. Deev (Kharkov): On some new forms of the general solution of the three-dimensional problem of the theory of elasticity expressed in harmonic functions.

104. A. A. Dertsachev (Kalinabad): Generalization of the method of steepest descent in structural mechanics.

105. B. V. Deriagin (Moscow), N. V. Sergin (Leningrad): Surface phenomena in the mechanics of clays.

106. A. E. Desov (Moscow): Experimental data concerning the propagation of vibrations of different frequencies in concrete mixtures.

107. G. Yu. Dzhanelidze (Leningrad): Almansi's problem.

108. M. I. Dlugach (Kiev): A finite difference analysis of cylindrical shells with rectangular holes.

109. M. I. Dlugach (Kiev): Generalization of Mohr's method of determining the displacements in problems of the theory of elasticity.

110. M. B. [illegible] (Kharkov): The construction of solutions of the equations of structural mechanics by means of special uniformly convergent series.

111. L. G. Drapkin (Leningrad): A method of investigating the state of stress and strain and the slip lines in anisotropic multilayer metals.

112. A. V. Distler (Dnepropetrovsk): The stability of an obliquely bent beam.

113. L. I. Distlovitskiy, L. B. Rabinovich (Kiev): A problem concerning elastic bodies whose configuration changes in the course of loading, with application to the erection of structures.

114. F. P. Dudakinov (Leningrad): On the shear strength of structural rock foundations.

115. F. P. Dudakinov (Leningrad): On friction in sandy soils and their shear strength.

116. K. S. [illegible] (Moscow): The deformation of the ground under annular foundations.

117. G. G. [illegible] (Moscow): On stresses and strains of thin-walled rods of variable cross section at normal and elevated temperatures.

118. Zh. S. Erzhanov (Dnepropetrovsk): Determination of the pressure on a tunnel facing taking account of the hereditary creep of soils.

119. Zh. S. Erzhanov (Dnepropetrovsk): The integral operator method of determining the creep characteristics of soils from observations in situ.

120. A. F. [illegible] (Gorki): The elastic-plastic bending of a bar.

121. A. M. Zhukov (Moscow): Elastic properties of a plastically deformed metals under combined loading.

122. F. A. Zhuravlev, A. F. Zakharevich, N. P. [illegible] (Leningrad): Application of the method of characteristics to the determination of the tension in the cable of a mine elevator.

123. N. A. [illegible] (Erevan): On the propagation of plastic zones in a beam under impulsive loading.

124. L. I. Zaitsev (Moscow): On the surface-head-wave.

125. V. V. [illegible], Sh. S. Katz (Leningrad): An experimental study of creep-rupture characteristics of tubes under combined stresses.

126. V. V. [illegible] (Moscow): The propagation of an elastic wave due to an underground explosion.

127. A. F. [illegible] (Moscow): On the state of stress in compression and its effect on the construction of Mohr's circles.

128. V. K. [illegible], Ya. B. Fridman (Moscow): The laws of deformation and rupture kinetics.

129. F. A. [illegible] (Leningrad): Flow of water-saturated soils under dynamic loading.

130. V. S. Ivanova (Moscow): The hypothesis of energetic similarity in fatigue fracture and the rolling of metals.

131. D. D. Ivlev (Voronezh): On the anisotropy of elastic and plastic bodies.

132. I. E. [illegible], Yu. I. [illegible] (Leningrad): Plastic tension and torsion of thin-walled nickel tubes that have become anisotropic through prior plastic deformation.

133. Yu. E. [illegible], B. F. [illegible] (Moscow): Investigation of elastic strains and vibrations in aircraft structures by means of electronic computers.

FRIDMAN, Ya.B.; GORDEYEVA, T.A.; ZAYTSEV, A.M.; GOL'DENBERG, A.A., kand. tekhn.nauk, retsenzent; SHKOL'NIK, L.M., kand.tekhn.nauk, red.; DOBRITSINA, R., tekhn.red.; UVAROVA, A.F., tekhn.red.

[Structure and analysis of various types of metal fracture] Stroenie i analiz izlomov metallov. Moskva, Gos.nauchno-tekhn. izd-vo mashinostroit.lit-ry, 1960. 127 p. (MIRA 13:3)
(Metallography)

VOLKOV, Sergey Dmitriyevich; FRIDMAN, Ya.B., prof., doktor tekhn.nauk, retsenzent; YERMAKOV, N.P., tekhn.red.

[Statistical theory of the strength of materials] Statisticheskaia teoriia prochnosti. Moskva, Gos.nauchno-tekhn.izd-vo mashinostroit. lit-ry, 1960. 175 p. (MIRA 13:7)
(Strength of materials)

FRIDMAN Ya B.

PHASE I BOOK EXPLOITATION SOV/3974

Ispytaniya detaley mashin na prochnost'; sbornik statey. Po materialam Komiteta prochnosti NTO Mashproma (Testing Machine Parts for Strength; Collection of Articles. Based on Data of the Committee on Strength of Materials of the Scientific and Technical Society of the Machine-Building Industry) Moscow, Mashgiz, 1960. 226 p. Errata slip inserted. 5,000 copies printed.

Reviewer: I.V. Kudryavtsev, Doctor of Technical Sciences; Ed.: S.V. Serensen; Ed. of Publishing House: L.N. Danilov; Tech. Ed.: G.Ye. Sorokina and L.P. Gordeyeva; Managing Ed. for Literature on General Technical and Transport Machine Building (Mashgiz): A.P. Kozlov, Engineer.

PURPOSE: This collection of articles is intended for designers and for workers at plant laboratories and scientific research institutes.

COVERAGE: The articles contain data on the experience gained by industry and research institutes in the field of full-scale and model testing of machine parts for strength. A number of theoretical considerations and the related experimental practice are presented. No personalities are mentioned. Most of the articles are accompained by references.

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Testing Machine Parts for Strength SOV/3974

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FRIDMAN, Ya. B.

PHASE I BOOK EXPLOITATION SOV/3566

Drozdovskiy, Boris Aleksandrovich, and Yakov Borisovich Fridman

Vliyaniye treshchin na mekhanicheskiye svoystva konstruktsionnykh staley (Effect of Cracks on the Mechanical Properties of Constructional Steels) Moscow, Metallurgizdat, 1960. 260 p. Errata slip inserted. 4,150 copies printed.

Ed.: N.V. Manakin; Ed. of Publishing House: A.L. Ozeretskaya; Tech. Ed.: M.K. Attopovich.

PURPOSE: This book is intended for metallurgists, designers, process engineers, and specialists in the strength of metals.

COVERAGE: The book is an analysis of experimental work on the failure of steels and other alloys and methods of evaluating the tendency of constructional steels to fracture. Special attention is given to methods of determining the ability of steel to resist crack propagation. The book is based primarily on experiments made by the authors and on investigations of other Soviet and non-Soviet specialists. No personalities are mentioned. There are 185 references

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FRIDMAN, YA. B

PHASE I BOOK EXPLOITATION SOV/4902

Akademiya nauk SSSR. Nauchnyy sovet po probleme zharoprochnykh splavov

Issledovaniya po zharoprochnym splavam, tom 6 (Investigations of Heat-Resistant Alloys, Vol. 6) Moscow, 1960. 319 p. Errata slip inserted. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A. A. Baykova. Nauchnyy sovet po probleme zharoprochnykh splavov.

Editorial Board: I. P. Bardin (Deceased) Academician, G. V. Kurdyumov, N. V. Ageyev, Corresponding Member, Academy of Sciences USSR (Resp. Ed.), I. A. Oding, L. M. Pavlov, and I. F. Zudin, Candidate of Technical Sciences; Ed. of Publishing House: V. A. Klimov; Tech. Ed.: S. G. Tikhomirova.

PURPOSE: This book is intended for research workers in the field of physics of metals and for metallurgists, particularly those working on heat-resistant alloys.

COVERAGE: This collection of 45 articles deals with various problems in the production of heat-resistant alloys. Special attention is paid to the mechanisms of deformation of such metals as aluminum, copper, iron, and nickel. Various defects and failures of metals are analyzed, and means for increasing the heat resistance and plasticity are described. Among the special problems discussed are: electrolytic conductivity of iron-aluminum alloys in the solid state; the mobility of atoms in nickel-iron alloys, depending upon defects of their crystalline structure; the kinetics of change in isolated pores; the irreversible thermal transformation of solid bodies, etc. No personalities are mentioned. References follow each article.

Gertsriken, S.D., I.Ya. Dekhtyar, and L.M. Kumok. Investigation of the Heat Resistance and Structure of Some Iron-Base Alloys, Depending on Their Composition	259
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AVAILABLE: Library of Congress

S/169/62/000/004/002/103
D228/D302

AUTHOR: Fridman, Ya. B.

TITLE: Patterns of solid body disintegration applicable to the problems of tectonophysics

PERIODICAL: Referativny zhurnal, Geofizika, no. 4, 1962, 9, abstract 4A60 (V sb. Probl. tektonofiziki, M., Gosgeoltekhizdat, 1960, 67-77)

TEXT: An attempt is made to apply certain patterns of building-material disintegration for explaining different cases of disintegration that are being studied in geology and geophysics. The main peculiarities of mechanical disintegration are considered: The localization, the main kinetic periods of deformation, and the influence of the elastic energy supply on rupture. The degree of localization of a rupture is not the same for different materials and depends on the presence and the magnitude of the plastically deformed volume undergoing disintegration. A structural irregularity diagram, on which regions of quasi-homogeneous structures

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f ... posi-
t ... cesses of
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de ... on the time, since such
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of ... development are determined.
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Patterns of solid ...

(the macrostrength) and heterogeneous structures (the microstrength) are distinguished, is examined. The emergence of cracks and the local plastic deformation alter the dimensions of the zone of maximal stress and can convert the structure from quasi-homogeneous to heterogeneous and vice-versa. Three main stages of disintegration -- submicroscopic (III variety), microscopic (II variety) and macroscopic (I variety) -- are considered. Four periods -- incubation, braking, quasi-stationary, and self-accelerating -- are distinguished in development of plastic deformation and disintegration. The experimentally determinable breaking-points usually reflect the transition from the first three precritical processes to the fourth transcritical one, in which the acceleration positively does not diminish. It is suggested that the processes of deformation and disintegration should be described by curves of the deformation acceleration's dependence on the time, since such curves characterize the process more sensitively than the usual curves of creep and may help to demarcate the main kinetic stages of disintegration and the motive forces of these processes. The character and the tempo of rupture development are determined,

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Patterns of solid ...

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apart from previously known factors, by the elastic energy reserve, accumulated by the system in the loading process. Disintegration can stop if there is an insufficient supply of energy. In the case of a surplus of supplied energy the disintegration process may acquire the character of an avalanche or a burst. [Abstracter's note: Complete translation.]

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FRIDMAN, Ya. B., doktor tekhn.nauk prof., MOROZOV, Ye. M., kand.tekhn.nauk

Selecting the direction of weld seams in vessels made of vinyl plastic. Khim.mash. no.2:37-38 Mr-Ap '60. (MIRA 13:6)
(Chemical apparatus--Welding) (Plastics--Welding)

Fridman, Ya. B

81821

S/129/60/000/07/006/013
E193/E235

18.8200

AUTHORS: Fridman, Ya. B., Doctor of Technical Sciences, Professor, and Yegorov, V. I., Engineer

TITLE: The Effect of Work-Hardening on the Tendency to Failure due to Thermal Fatigue

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1960, No. 7, pp. 27-30

TEXT: The object of the present investigation was to study the effect of cyclic temperature variation on the mechanical properties of work-hardened and annealed austenitic steel 1Kh18N9T, containing 0.1% C, 1.1% Mn, 20% Cr, 11% Ni, 0.97% Ti, 0.019% S, and 0.014% P. The experiments were carried out on test pieces 6 mm diameter which, after quenching from 1100°C, were subjected to cyclic temperature changes, both in the as-quenched (annealed) condition and after a preliminary plastic deformation (in tension) of 5 and 20%. The duration of each cycle was 9 min, 7 min being allowed for the specimen to reach the upper temperature limit (600, 720, or 800°C) and 2 min to cool down to room temperature by quenching in water. After a number (up to 700) of such cyclic temperature variations,

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The Effect of Work-Hardening on the Tendency to Failure due to Thermal Fatigue

the true tensile strength S_K, U.T.S. (σ_v), and the reduction of area, ϕ, of the specimens were determined. To check whether the observed changes in the mechanical properties of the investigated material were not produced by heating the material to high temperature alone, several specimens were held at 720°C for periods equal to those during which the corresponding specimens, subjected to cyclic temperature variation, stayed at this temperature, after which their mechanical properties were also determined. Finally, the effect of the cyclic temperature variation on the notch sensitivity of the investigated steel was studied on specimens in which holes 1.5 mm diameter had been drilled prior to the experiments. Several conclusions were reached. (1) Cyclic temperature variation lowers the strength and ductility of both annealed and work-hardened austenitic steel to the extent which depends on the upper temperature limit of the heating/cooling cycles and the number of cycles. (2) The observed reduction in strength and ductility is due to the action of

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The Effect of Work-Hardening on the Tendency to Failure due to Thermal Fatigue

stresses set up in the material during cyclic heating and cooling. Prolonged heating at temperatures employed in the course of the present investigation, has no harmful effect on the properties of the steel studied. (3) Preliminary plastic deformation has no significant effect on the sensitivity of steel 1Kh18N9T to cyclic temperature variation when the number of the heating/cooling cycles is relatively small. However, when a certain critical number of cycles, which depends on the upper temperature limit, is exceeded, strength and ductility of work-hardened steel decrease more rapidly than those of the annealed material. (4) The harmful effect of preliminary plastic deformation is apparently not removed by the processes of recovery and recrystallization which must take place when the specimens are heated. (5) The presence of stress risers in the specimens of steel 1Kh18N9T, subjected to cyclic temperature variation between 800 and 20°C, results in a sharp decrease in their

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The Effect of Work-Hardening on the Tendency to Failure due to Thermal Fatigue

strength. There are 5 figures and 7 references: 5 Soviet and 2 English.

ASSOCIATION: Moskovskiy inzhenergo-fizicheskiy institut (The Moscow Institute of Physics and Technology)*

*[Annotation: Correctly Moscow Engineering-Physical Institute]

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4

S/145/60/000/010/006/014
D262/D304

10.7000

AUTHORS: Fridman, Ya. B., Doctor of Technical Sciences, Professor and Morozov, Ye. M., Candidate of Technical Sciences

TITLE: The effect of anisotropy of strength of materials on their mechanical properties

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Mashinostroyeniye, no. 10, 1960, 89 - 93

TEXT: If the anisotropy is sufficiently strong, failure can take place before the strength limit is reached. The author studies the failure of a material, whose strength surface has the form of an ellipsoid, in a plane stressed state. It is found that failure in a plane perpendicular to limit stress σ_b takes place only when the degree of anisotropy above $\sqrt{3}$ failure occurs not at max. normal stresses and the degree of anisotropy cannot be determined by the limit stress σ_b. The apparent degree of anisotropy, found in expe- /

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riments, i.e. $\xi_1 = \frac{\sigma_b}{S_{min}}$, S_{min} being the minor axis of the strength ellipsoid, and the relationship between the apparent and actual degrees of anisotropy is given by

$$C_1 = \frac{A_3 A_5 - A_2 A_6}{A_1 A_5 - A_2 A_4}, \qquad C_2 = \frac{A_1 A_6 - A_3 A_4}{A_1 A_5 - A_2 A_4}. \qquad (6)$$

Similar features are observed in cases of anisotropy of shear resistance. There are 5 figures and 6 Soviet-bloc references.

ASSOCIATION: Moskovskiy inzhenerno-fizicheskiy institut (Moscow Institute of Physics and Engineering)

SUBMITTED: June 20, 1960

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77237
SOV/89-8-2-2/30

AUTHORS: Kramerov, A. Ya., Fridman, Ya. B., Ivanov, S. A.

TITLE: Thermal Stresses in Reactor Structures

PERIODICAL: Atomnaya energiya, 1960, Vol 8, Nr 2, pp 101-111 (USSR)

ABSTRACT: Introduction. Specific operating conditions of nuclear reactors stimulated many studies of thermal stresses and their causes, in particular, studies of: (a) intensive neutron and γ-radiations lowering ductility at low temperatures; (b) internal sources of radiative heat-generation; (c) high heat flows (10^6 kcal/m^2·h) and heat-generation densities (10^9 kcal/m^3·h) which cause large temperature gradients (approximately 100° C/mm); (d) applications of new, little-known materials and combinations of materials with different thermal expansion coefficients; (e) thermal shocks in structures (like those following sudden shutdowns of reactors in case of damage); and (f) use of new complex structures not having analogs in conventional engineering, nor

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being tested during continuous operation. Estimate of the Magnitude of Thermal Stresses. The authors first review the known facts that in the case of very high thermal stresses the body or parts of it become ductile, causing thermoplastic stresses which depend also on the "prehistory" of the body. Ther thermoplastic stresses can be computed by known approximate methods. In the elastic region stresses determined at any moment by the temperature field, and the temperature fields themselves, can be obtained using known system of equations for thermal conductivity and theory of elasticity. For the case of bodies with cylindrical symmetry, often encountered in reactors, there exist known equations valid in the case of no outside field, for the azimuthal, radial, and axial normal thermoelastic stresses of the first order σ_θ, σ_r, and σ_z.

$$\sigma_\theta = \frac{E}{1-\nu}\left(\frac{1}{r^2}\frac{r^2+a^2}{b^2-a^2}\int_a^b \alpha\Delta T(r)\,r\,dr + \right.$$

$$\left. + \frac{1}{r^2}\int_a^r \alpha\Delta T(r)\,dr - \alpha\Delta T(r)\right); \qquad (3)$$

$$\sigma_r = \frac{E}{1-\nu}\left(\frac{1}{r^2}\frac{r^2-a^2}{b^2-a^2}\int_a^b \alpha\Delta T(r)\,dr - \right.$$

$$\left. - \frac{1}{r^2}\int_a^r \alpha\Delta T(r)\,r\,dr\right) \qquad (4)$$

and

$$\sigma_z = \sigma_\theta + \sigma_r. \qquad (5)$$

where E is Young's modulus (kg/cm^2); ν is Poisson coefficient; $\Delta T = T_r - T_{or.}$ is the change in temperature with respect to the original temperature (T_{or})

APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000513720012-0"

of the unstressed state; a, b are the inner and outer radii of the tubing; α is the coefficient of thermal linear expansion. The authors discuss some special cases, and derive the known equation

$$\sigma = \frac{E}{1 - cv} (\overline{\alpha \Delta T} - \alpha \Delta T). \qquad A$$

where $\overline{\alpha \Delta T}$ is the value of the mean free thermal stretching, and c can take the values of 0, 1, and 2 for the uniaxial, biaxial, and volume stresses respectively. This equation enables one to find the largest stress in a cylindrical bar, thick-walled tube, in a plate with fixed ends, and a symmetrical temperature distribution in some other cases when principal deformations in every point are equal to one another, or some of them are equal to zero (linear and plane stress states), and also if they are constant over any main surface. The authors note that little was done to develop methods for evaluating

thermal stresses of the second order. Thermal stresses of the first order and temperature distributions may be represented as a sum of the particular solution of the homogeneous equation (without internal sources of heat and actual boundary conditions--index Δ T) and the solution of the heat transfer equation with internal heat sources and a zero boundary condition (index q). This is a consequence of the linearity of the heat transfer equation. Each of these solutions can in turn be written as a product of three terms, expressing respectively the influence of the physical properties, density of heat generation, and the size (or ΔT_b) and shape of the bodies. The authors obtained

$$\sigma = \sigma_q + \sigma_{\Delta T} = \left[\frac{\alpha E}{1-\nu}\frac{1}{\lambda}\right]\left[\frac{q r_0^2}{4}\right]\Psi_{\sigma_q} + \left[\frac{\alpha E}{1-\nu}\right]\left[\frac{\Delta T b}{2}\right]\Psi_{\sigma_{\Delta T}}. \qquad 8$$

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by using Eq. (2)

$$\Delta T = \frac{q_F \frac{1}{2} r_0}{\lambda} = \frac{1}{\lambda} \frac{Q}{F_q} \frac{V}{F_q} = \frac{q}{4\lambda} r_0^2. \qquad (2)$$

for the temperature difference across the cross section of a more of less plastic body, in the presence of internal heat sources. Here q is the density of heat generation rate (kcal/m^3·h); $1/2\ r_o = 1/2\ \frac{2V}{F_q}$ is the quantity proportional to the mean distance of travel of heat in the body; V is the volume of the body (m^3); $q_F = \frac{Q}{F_q}$ is the heat flow (kcal/m^2·h); Q is the total heat transfer rate (kcal/h); F is the surface of the heat exchange; and Ψ is the form factor, equal to the ratio of stresses (or temperature drops) on the

body of a given shape to those in a cylinder (all other conditions being equal). If we neglect neutron energy absorption, we have to take into account only the average absorption of γ-rays, which is proportional to the specific gravity for elements in the middle of the Atomic Table. We do this by modifying the first factor (expressing the influence of physical factors) in Eq. B into

$$\frac{\alpha E}{1-\nu} \frac{\gamma}{\lambda} . \qquad C$$

Introducing finally the ratio σ / σ_D, the term accounting for physical properties becomes

$$\frac{\alpha E}{1-\nu} \frac{1}{\lambda \sigma_T} . \qquad D$$

adjusted for the possibility that the body becomes plastic. It is difficult to avoid the transition to the domain of irreversible deformation when working with materials of high α and low λ and σ_D. Uranium and stainless steel in this respect are poor. In spite of their low σ_B and σ_T value, thorium, graphite, and, in a smaller degree, zirconium and aluminum are less liable to produce permanent deformations. (Abstracter's Note: λ, $\sigma_{D(uctile)}$ and σ_B were never defined in this article.) The authors point out that even without touching the problems of cost, radiation stability, and corrosion stability of materials, their comparison concerning the thermal stress stability represents an extremely complex and conditional problem. Appropriate complex coefficients should contain reliability coefficients which are still vague for many ductile materials subjected to thermal fatigues. The influence of the σ_D quantity is not well defined since its increase

sometimes turns out to be harmful (because of a slower relief from the thermal stresses of the plasic deformation), but can also have useful influences, such as a reduction of accumulation of plastic deformations. In addition, many properties depend on the preparation and structure of the material. Comparison of heat-generating elements of various shapes. The authors require that for comparison purposes all the elements have the same volume per unit of the heat-emitting surface. They present an equation for maximum temperature drops and macrotemperature elastic stresses of the first kind for four basic cross sections of heat-producing elements (not taking into account heat production). The temperature drop $\frac{qr_o^2}{4\lambda}$ along r_o is denoted by ΔT_o, and the maximum thermoelastic stresses in the cylinder $\frac{\alpha E}{1-\nu}\frac{\Delta T_o}{2}$ is denoted by σ_o. These equations were obtained after solving the equations for stationary heat transfer $(-\lambda \Delta T = q)$, assuming

appropriate boundary conditions. The derivation of the most complicated third case is presented in the Appendix. In case 1 concerning a tube or cylinder cooled from the outside

$$\Delta T_{max} = \Delta T_0 \Psi^{(1)}_{\Delta T_q}, \quad (\sigma_\phi)_{r=b} = \sigma_0 \Psi^{(1)}_{\sigma_q}.$$

Case 2 represents represents a tube cooled from the inside,

$$\Delta T_{max} = \Delta T_0 \Psi^{(2)}_{\Delta T_q}; \quad (\sigma_\phi)_{r=a} = \sigma_0 \Psi^{(2)}_{\sigma_q}.$$

In the case 3 the tube is cooled both from the inside and outside

$$\Delta T_{max} = \Delta T_0 \frac{1-\tilde{\varrho}^2(1-\ln\tilde{\varrho}^2)}{(1-\varrho)^2},$$

where

$$\tilde{\varrho}^2 = \frac{R^2}{b^2} = \frac{1}{\ln \varrho^2}\left[\frac{\Delta T_b}{\Delta T_0}(1-\varrho^2)+\varrho^2-1\right]$$

and R is the radius $(a < R < b)$ of the circle where $T = T_{max}$ and $\rho = a/b$. In case 4 concerning a plate cooled from two sides

$$\Delta T_{max} = \Delta T_0 \frac{1}{2}\left(1+\frac{\tilde{x}}{\delta}\right)^2,$$

where $\frac{\tilde{x}}{\delta} = 1/2 \frac{\Delta T_B}{\Delta T_o}$ and $\tilde{x}$ distance from the center of the plate (of thickness δ) to the point of maximum temperature $(T(\tilde{x}) = T_{max})$. The significance of parameters b, Ψ_{Tq}, Ψ_{σ_q}, and $\Psi_{\sigma \Delta T}$ is shown in Table 1, and in Figs. 1, 2, and 3.

Table 1. Influence of the shape of bodies on the temperature drop and temperature stress (Basic formulas).

Parameter	Tube or cylinder cooled from outside (case 1)	Tube cooled from inside (case 2)	Tube cooled from outside and inside	Plate cooled from two sides (case 4)
Outer radius (half-thickness), b (or δ)	$\frac{r_0}{1-\varrho^2}$	$\frac{r_0\varrho}{1-\varrho^2}$	$\frac{r_0}{1-\varrho}$	$\frac{r_0}{2}$
Inner radius, a	$\frac{r_0\varrho}{1-\varrho^2}$	$\frac{r_0\varrho^2}{1-\varrho^2}$	$\frac{r_0\varrho}{1-\varrho}$	—
Dimensionless temp. drop (form factor) due to inner heat-generating sources $\Psi_{\Delta T_q}$	$-\left(\frac{1}{1-\varrho^2}+\frac{\varrho^2 \ln \varrho^2}{(1-\varrho^2)^2}\right)$	$\frac{\varrho^2}{1-\varrho^2}+\frac{\varrho^2 \ln \varrho^2}{(1-\varrho^2)^2}$	$\frac{1}{(1-\varrho)^2}+\frac{1+\varrho}{(1-\varrho)\ln \varrho^2}\left[1-\ln\frac{\varrho^2-1}{\ln \varrho^2}\right]$	$\frac{1}{2}$

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Table 1 Cont'd

Parameter	Tube or cylinder cooled from outside (case 1)	Tube cooled from the inside (case 2)	Tube cooled from the outside and inside (case 3)	Plate cooled from two sides (case 4)
Dimensionless thermal stresses (form factor):				
due to inner heat-generating sources, Ψ_{σ_q}	$\frac{2\varrho^2}{(1-\varrho^2)^2}\left(\frac{1-\varrho^2}{2\varrho^2}-\frac{\varrho^2\ln\varrho^2}{1-\varrho^2}-1\right)$	$-\frac{2\varrho^2}{(1-\varrho^2)^2}\left(\frac{1-\varrho^2}{2}+\frac{\ln\varrho^2}{1-\varrho^2}+1\right)$	$\frac{1+\varrho^2}{(1-\varrho)^2}+\frac{1+\varrho}{(1-\varrho)\ln\varrho}$	$\frac{2}{3}$
due to temp. differences on cooled surfaces, $\Psi_{\sigma_{\Delta T}}$	—	—	$\left\{\begin{array}{l} -\left(\frac{1}{\ln\varrho}+\frac{2}{1-\varrho^2}\right)_{r=a} \\ -\left(\frac{1}{\ln\varrho}+\frac{2\varrho^2}{1-\varrho^2}\right)_{r=b}\end{array}\right.$	1

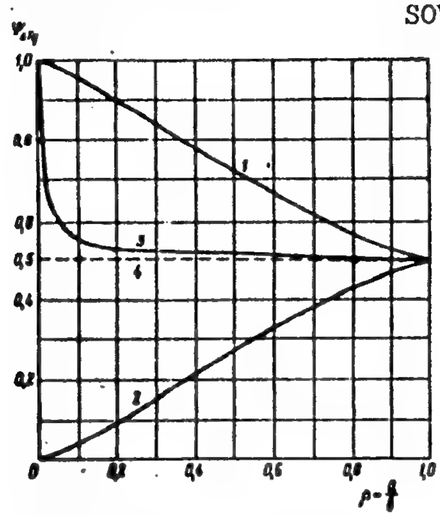

Fig. 1. Dimensionless temperature drop $\Psi_{\Delta T_q} = \frac{\Delta T_{max}}{\Delta T_0}$, due to inner heat-generating sources as a function of the dimensionless inner tube radius $\rho = a/b$ (for cases 1 to 4)

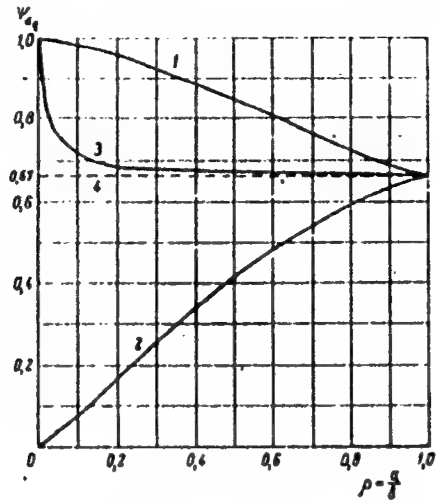

Fig. 2. Dimensionless thermal stresses $\Psi_{\sigma_q} = \frac{\sigma_q}{\sigma_o}$ (in presence of inner heat-generating sources) as functions of the dimensionless inner tube radius $\rho = a/b$ (for cases 1 to 4).

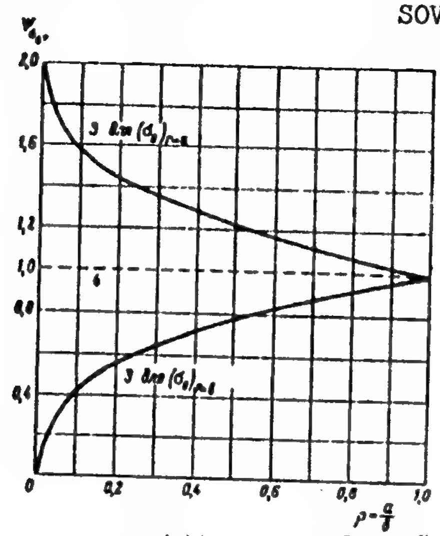

Fig. 3. Dimensionless thermal stresses $\Psi_{\sigma_{\Delta T}} = \frac{\sigma_{\Delta T}}{\frac{\alpha E}{1-\nu}\frac{\Delta T}{2}}$, due to temperature differences on the dimensionless inner tube radius $\rho = a/b$ (for cases 3 and 4).

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Data in Fig. 1 to 3 agree with calculations done in a more involved manner by Mercxs (see reference in Abstract) for a particular case. Estimates of Dangers From Thermal Stresses. The authors state that in the case of a small number of repeated temperature variations of ductile materials due to relief from thermal tensions, the stationary temperature field usually does not lead to dislocations. One should worry in this case only about excessive deformations or damage to the materials during possible overheating. Repeated build-up of residual deformations and changes in structure are more dangerous than the nonstationary state itself. The authors also discuss the role of creeps and formations of cracks on thermal stresses. Reduced stability to repeated heating of coarse-grained materials is probably due to large dislocations on the grain boundaries. Residual deformations seem to be useful since they are capable of relaxing stresses. In particular, the smaller the thermal expansion, the faster the relaxation of thermal stresses. In the mechanical case the speed of relaxation is proportional to the stored energy. Ways To Reduce the

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Danger From Thermal Stresses. One way of reducing these dangers is to reduce thermal stresses by: (a) utilizing materials with a small value of the $\alpha E/\lambda$ complex, and joining together materials with similar $(\alpha \Delta T)$; (b) choosing shapes permitting maximum free expansion; (c) utilizing smooth shapes and homogeneous cooling conditions; and (g) securing operating conditions which exclude significant and repeated variations in temperature. The second way is to increase the stability of materials by satisfying two requirements contradictory in a sense: (2) augmenting the ductile limit to the point where there is no piling-up of dangerous residual deformations; and (b) by improving the plastic properties of the material, their homogeneity, and fineness of their grain structure. The authors emphasize the importance of the use of smoothly machined surfaces. Conclusions. The methods of the theory of elasticity have two principal limitations: they (a) cannot give account about the microbehavior of the materials, and microstresses,

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together with macrostresses, are an important factor in the starting phases of breakdowns; and (b) they do not take into account effects of the elastically ductile region. The authors emphasize the resulting need for approximate estimates. They also emphasize the need for further experiments which would determine the influence of the number, amplitude, and suddenness of temperature changes on plastic deformations. It would be advantageous to have a characteristic of the material describing its resistance to thermal stresses; e.g., the curve of residual deformation versus the number of thermal cycles up to the appearance of microcracks of preassigned size. There is 1 table; 3 figures; and 18 references, 12 Soviet, 1 Austrian, 1 French, and 4 U.S. The U.S. references are: B. Langer, Trans. ASME, 77, Nr 5 (1958); K. Mercxs, Trans. ASME, 80, Nr 5 (1958); B. Gatewood, Thermal Stresses, U.S.A. (1957); R. Dane, AEC publication: Nuclear Reactors, Vol II (1957).

SUBMITTED: May 9, 1959

S/032/60/026/04/23/046
B010/B006

AUTHORS: Fridman, Ya.B., Sobolev, N.D., Yegorov, V.I.

TITLE: Thermal Fatigue Tests Under Conditions of Pure Shearing Stresses

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 4, pp. 467-472

TEXT: Giving several examples, the state of stress in workpieces subjected to cyclic temperature variations is discussed. It is pointed out that all states of stress and deformation (monoaxial, biaxial, triaxial) can occur under the influence of temperatures realized under practical conditions. It would therefore be necessary to lay down the technical theory of strength, since the behavior of material in an arbitrary state of stress can, according to the well known criterion of strength, be determined from the test results of a simple state of stress. First experiments in this direction were made by V.N. Kuznetsov (Ref. 2) and L. Coffin (Ref. 3). Kuznetsov regarded the deformation energy as criterion of strength. As the results obtained by the two investigators are in good agreement, it may be assumed that the deformation energy can be regarded as criterion of strength. In the present publication, a

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Thermal Fatigue Tests Under Conditions of Pure Shearing Stresses

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method for testing thermal fatigue under pulsating torsion is described, in which an alternating state of pure shearing stress occurs. The fact that the extreme deformation values correspond to the extreme values of test temperatures was taken into account when working out the test method, and a corresponding testing apparatus (Fig. 3, scheme) was designed. The amplitude of the torsion angle of the sample can be varied within a wide range. Specimen heating is effected by passing a current through, while the coolant flows through the specimen via an electromagnetic EMK valve. An EPV-01 potentiometer is used to control the heating-cooling cycle. Tests were carried out using special thin-walled tube specimens (Fig. 5) made of refractory alloys. Temperature cycles of 630°⇄70° and various mechanical deformation amplitudes were applied. From test results obtained, the fatigue curves were plotted in the semilogarithmic coordinates "deformation change - number of stress cycles up to destruction" (Fig. 7). A publication by S.V. Serensen and P.I. Kotov is mentioned in the present paper. There are 8 figures and 4 references, 3 of which are Soviet.

ASSOCIATION: Moskovskiy inzhenerno-fizicheskiy institut (Moscow Institute of Engineering and Physics)

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S/032/60/026/05/60/063
B010/B008

AUTHORS: Zilova, T. K., Fridman, Ya. B.

TITLE: I Vsesoyuznyy s"yezd po teoreticheskoy i prikladnoy mekhanike (1st All-Union Conference on Theoretical and Applied Mechanics)

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 5, pp. 647-648

TEXT: The Conference mentioned in the title was held in Moscow from January 27 to February 3, 1960 and was organized by the Natsional'nyy Komitet SSSR po teoreticheskoy i prikladnoy mekhanike (National Committee of the USSR for Theoretical and Applied Mechanics), the Otdeleniye tekhnicheskikh nauk AN SSSR (Department of Technical Sciences of the AS USSR), the Institut mekhaniki AN SSSR (Institute of Mechanics of the AS USSR) and the Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov). The Congress was held in 3 sections: 1st section - general and applied mechanics under the chairmanship of M. V. Keldysh; 2nd section - mechanics of liquids and gases, chairman L. I. Sedov and 3rd section - mechanics of the solid,

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I Vsesoyuznyy s"yezd po teoreticheskoy i prikladnoy mekhanike (1st All-Union Conference on Theoretical and Applied Mechanics)

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chairman N. I. Muskhelishvili. Besides the delegates from the Soviet Republics, visitors from Czechoslovakia, Poland, Rumania, France, the USA etc. attended the Conference. About 100 lectures were delivered in the 1st section, more than 230 in the 2nd section and more than 300 in the third section. A survey with short thematic explanations of the lectures read in the 3rd section is given. The following authors and titles are mentioned: A. A. Il'yushin "Problems of the Theory of the Plasticity at Complicated Loads"; Yu. N. Rabotnov (Novosibirsk) "The Creepage"; L. M. Kachanov (Leningrad) "On the Problem of the Breaking Time Under Creep Conditions"; B. F. Shorr (Moscow) "The Creepage of Irregularly Heated Bodies"; V. P. Rabinovich and Yu. N. Rabotnov "Strength of the Turbine Disks Under Creep Conditions"; A. V. Burlakov (Khar'kov) gave results on the creepage of turbine diaphragms; A. N. Grubin (Leningrad) "Stress Concentration at the Elongation of Flat Notched Samples Under Conditions of Greater Creep Deformations"; B. V. Zver'kov and Sh. N. Kats (Leningrad) reported on the Fracture and the Creepage of Tubes From Slightly Alloyed and Austenitic Steels; V. L. Agamirov, A. S. Vol'mir, V. Ye. Mineyev (Moscow) "Strength and Overcritical Deformation of Casings at

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Dynamic Loads"; G. I. Barenblat (Moscow) "Theory of Equilibrium Cracks Which Develop at the Brittle Fracture" explained some hypotheses by Griffiths, Ya. I. Frenkel' and A. R. Rzhanitsyn (papers by P. A. Rebinder and S. A. Khristianovich are mentioned in this connection); M. Ya. Leonov and V. V. Panasyuk "On the Development of Finest Cracks"; G. V. Uzhik reported on the influence of the concentration of the stresses on the criteria of the strength and fracture; V. S. Ivanova compared some computation values of the fatigue limits; Ya. B. Fridman and T. K. Zilova "Regularities of the Kinetics of the Deformation and the Fracture on the Basis of a Study of the Dependence in Time of the Second Derivatives (Accelerations) of the Plastic Deformation and the Fracture"; calculation methods for metal working by pressing and hammering were explained in the contributions by L. G. Stepanskiy, Ye. P. Unksov, V. G. Osipov et al; problems of the experimental method for the determination of stresses and deformation were explained in the contributions by N. I. Prigorovskiy (Moscow); A. Ya. Aleksandrov (Novosibirsk) "Experimental Investigation of Flat Elastic-plastic Problems"; L. G. Drapkin investigated the stressed and deformed phase of anisotropic,

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I Vsesoyuznyy s"yezd po teoreticheskoy i prikladnoy mekhanike (1st All-Union Conference on Theoretical and Applied Mechanics)

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multilayer metals; A. M. Gol'dberg and V. G. Korotkin (Leningrad) "Theoretical and Experimental Computation Methods of the Strength of Lock Constructions of the Stalingradskaya GES (Stalingrad Hydroelectric Power Station)" and Belan, Petku, Reutu (Bucharest, Rumania) reported on plastic materials which change their color at the yield point.

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S/032/60/026/008/004/0
B015/B064

AUTHORS: Feldman, Ya. B., Yegorov, V. I.

TITLE: Influence of the Yielding of the Loading Device on the Process of Deformation and Destruction of Materials

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 8, pp. 980-984

TEXT: The process of the extension of cracks in some materials was investigated at varying yielding of the loading device in consideration of [illegible] given by T. K. Zilova. A special device (Fig. 1) was designed which allows static bending tests with simultaneous microscopic examination of the crack formation. The tests were carried out at a yielding of the loading device of $6 \cdot 10^{-3}$ mm/kg and $51 \cdot 10^{-3}$ mm/kg. Notched specimens of oriented organic glass as well as of metal alloys of the types В 95 (V 95) and Д 16 (D 16) were examined. The tests made with organic glass showed that the effect of the yielding of the loading device on the breaking load depends on the diameter of the notch (Table). The results obtained in testing the above alloys also showed that the yielding of the

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Influence of the Yielding of the Loading Device on the Process of Deformation and Destruction of Materials

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loading device exerted an influence upon the diagram of static bending of the specimen. This influence is greater in the V 95 alloy (Fig. 4). V. R. Regel' is mentioned in the paper. A paper by B. V. Perov and M. M. Gudimov (Ref. 13) is referred to in connection with the physical and mechanical properties of organic glass. There are 4 figures, 1 table, and 14 references: 12 Soviet and 2 German.

ASSOCIATION: Moskovskiy inzhenerno-fizicheskiy institut (Moscow Physics and Engineering Institute)

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S/032/60/026/009/007/018
B015/B058

AUTHOR: Fridman, Ya. B.

TITLE: Deviations From Similarity, Modeling and Scale Factor

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 9, pp. 1104 - 1106

TEXT: The present paper belongs to a series of discussions published in this periodical. In his explanations, the author points out among other things that dimensionless and absolute characteristics should be applied for the evaluation of mechanical properties. Apart from the geometrical and mechanical similarities, other types of similarity must be considered, such as temperature, structural, kinetic similarities, etc. An elaboration of the conditions of kinetic similarity is of special importance. The author points out that very often a change of the scale factor takes place with secondary phenomena, which lead to basic differences in structure and properties between small and larger samples. In such cases, not only the deviations from similarity cause the scale effect, but also the differences in the material of the small

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Deviations From Similarity, Modeling and Scale Factor

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and large samples compared. By elaborating and applying the theory and criteria of similarity, the many reasons for the "scale effect" can be divided into two groups being heterogeneous by nature: 1) the non-existence of a physical similarity, and 2) the change of structure and properties of the material in small and larger samples, whereby different materials are compared with each other as to their properties. There are 5 Soviet references.

ASSOCIATION: Moskovskiy inzhenerno-fizicheskiy institut (Moscow Engineering and Physics Institute)

Card 2/2

FRIDMAN, Ya.B., prof., doktor tekhn.nauk; MOROZOV, Ye.M., kand.tekhn.nauk

Effect of the anisotropy of the strength of materials on their mechanical properties. Izv. vys. ucheb. zav.; mashinostr. no. 10:89-93 '60. (MIRA 14:1)

1. Moskovskiy inzhenerno-fizicheskiy institut.
(Strength of materials)

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S/032/60/026/011/020/035
B004/B067

AUTHORS: Fridman, Ya. B., Zilova, T. K., Drozdovskiy, B. A., and Petrukhina, N. I.

TITLE: Evaluation of Mechanical Characteristics in Consideration of the Deformation and Destruction Kinetics

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 11, pp. 1267 - 1283

TEXT: The authors discuss the effect of the kinetics of deformation processes on the durability of the material. A pre-critical state (the process is delayed $j < 0$) and a trans-critical state ($j > 0$) may be distinguished when determining the acceleration j of the deformation process. Also the critical point at which j changes its sign may be determined. The consideration of the kinetics is especially important in establishing the modern working conditions for apparatus with a) high operation temperatures, b) high average stress applied for short time, c) nonperiodic stress due to distorted fields of stress in complex designs and irregular action of temperature, corrosion or radiation, and

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Evaluation of Mechanical Characteristics in Consideration of the Deformation and Destruction Kinetics

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d) structural instability of the material. The following is distinguished in the transcritical state: 1) incubation period, 2) braking period, 3) steady period, and 4) final period sometimes taking place avalanche-like. The mechanical characteristics of the individual periods were defined and discussed. The effect of elastic energy and relaxation on the deformation kinetics is discussed by examples of material testing of X15H9Ю (Kh15N9Yu) and X17H5M3 (Kh17N5MZ) steels and B95 (V95) and B96 (V96) lightweight alloys and the effect of asymmetrical indentations as well as of surface changes due to thermal processes is explained. B. A. Palkin, N. V. Ryazanov, Yu. A. Bulanov, and T. V. Avdyunina are mentioned. Reference is made to a paper by E. I. Braynin. There are 14 figures, 5 tables, and 42 references: 37 Soviet, 1 US, 1 Austrian, 2 British, 1 German, and 1 Japanese.

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ZILOVA, T.K.; PETRUKHINA, N.I.; PALKIN, B.A.; RYAZANOV, N.V.; FRIDMAN, Ya.B.; prinimali uchastiye: BULANOV, Yu.A., KOS'KINA, V.N.

Tension and torsion testing of studs at different flexibility of load-applying devices. Zav.lab. 27 no.7:877-883 '61. (MIRA 14:7)

(Materials--Testing)

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21.1300 (1138, 1425, 1504)

S/089/61/010/006/005/011
B136/B201

AUTHORS: Fridman, Ya. B., Sobolev, N. D., Borisov, S. V. Yegorov, V. I., Konoplenko, V. P., Morozov, Ye. M. Shapovalov, L.A. and Shorr, B. F.

TITLE: Some problems of thermal strength in reactor construction

PERIODICAL: Atomnaya energiya, v. 10, no. 6, 1961, 606 - 619

TEXT: The general idea of the failure of thermal strength includes two types of fracture: the gradual (subcritical) fracture as a consequence of an extreme deformation or of a great number of cracks or of large-sized cracks; causes and manifestations of those fractures are discussed, and the loss of elastic or plastic strength on the passage through the critical state. Either type of fracture may be brought about by four causes of stress: 1, mechanical or thermal shock stresses; 2, brief static loads for some minutes or hours; 3, static loads for some months or years; 4, periodic loads. Fig. 1 presents examples in the variation of elastic and plastic conditions in a tube, and a fictitious elastic tension is shown to arise in the plastic zone (dashed line), while the forms of mechanical

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and thermal stress are intercompared in Fig. 4. Creep arises in nonuniformly heated structural elements, and cracks appear as a consequence of plastic deformation, particularly with materials having a low plasticity at room temperature. For calculating the creeping process the assumption is made on the basis of the creep theory that there is a functional relationship between the rate of creep v_i, the instantaneous stress σ_i, the temperature T, the time τ, and the plastic deformation P, namely, $v_i = v_{i\infty}\left(\frac{P}{P_*}\right)^{-\alpha}$. Here, $P = \int_0^{\tau} v_i d\tau$; $v_{i\infty} = f_{\infty}(\sigma_i, T)$; $P_* = f_*(\sigma_i, T)$. The thermal fatigue fracture has much in common with the mechanical one. It can be therefore determined from the known mechanical properties of a material. Whereas, however, the thermal fracture appears already after 10^3-10^4 cycles, the mechanical one takes 10^7-10^8 cycles to appear. A characteristic feature of the thermal fracture is the local deformation in zones with a particularly large temperature difference also in homogeneous fields of stress. This is also related to the appearance of high microstresses (Table 3). For sudden thermal shocks the temperature jump giving rise to a brittle fracture may

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be estimated by an equation. Of importance in the practice, however, is the creep character and the durability of the material under combined mechanical and nonsteady thermal loads. Experimental results are illustrated in Fig. 9, where the curves of variation of length-versus-time (scale 400:1) are compared with the cyclic temperature curve II and the thermal and elastic deformation III. As opposed to combined stress conditions, in which the strain-stress characteristic concerned is worsened with increased temperatures, stresses in case of a purely thermal stress are of a thermal origin and lead to bulging of structural elements in the hot zones, without, however, causing their breakdown. The micromechanical properties were checked in two ways. The principle of the second is illustrated in Fig. 13, while the results of the former - for static elongations and at 1400 - 1500°C in vacuum or in a controlled atmosphere, are presented in Fig. 12. In Fig. 13, 1 denotes the sample with a cross section of 2 X 1 or 3 X 1 mm, that is placed in a groove milled out from block 2. The pressure is yielded by stamp 3 made of tungsten briquettes 4. The resulting breakdown is indicated over contact 7. There are 13 figures, 3 tables, and 39 references: 27 Soviet-bloc and 12 non-Soviet-bloc. The three most recent references to English-language publications

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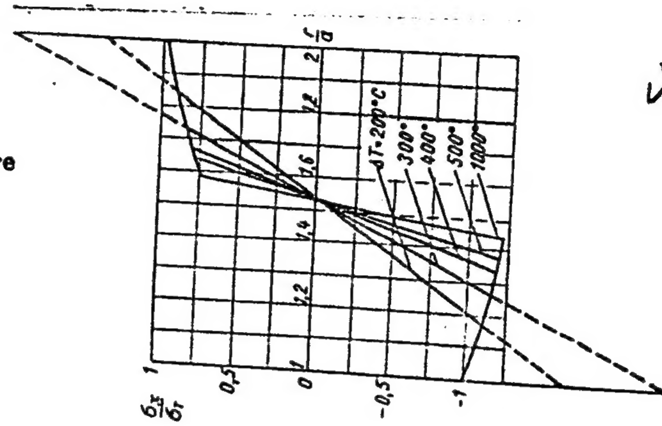
Legend to Fig. 1: Distribution of axial stresses and enlargem..nt of the plastic zone in a thick-walled tube with various temperature jumps: r - radius of an arbitrary point; a - inner radius



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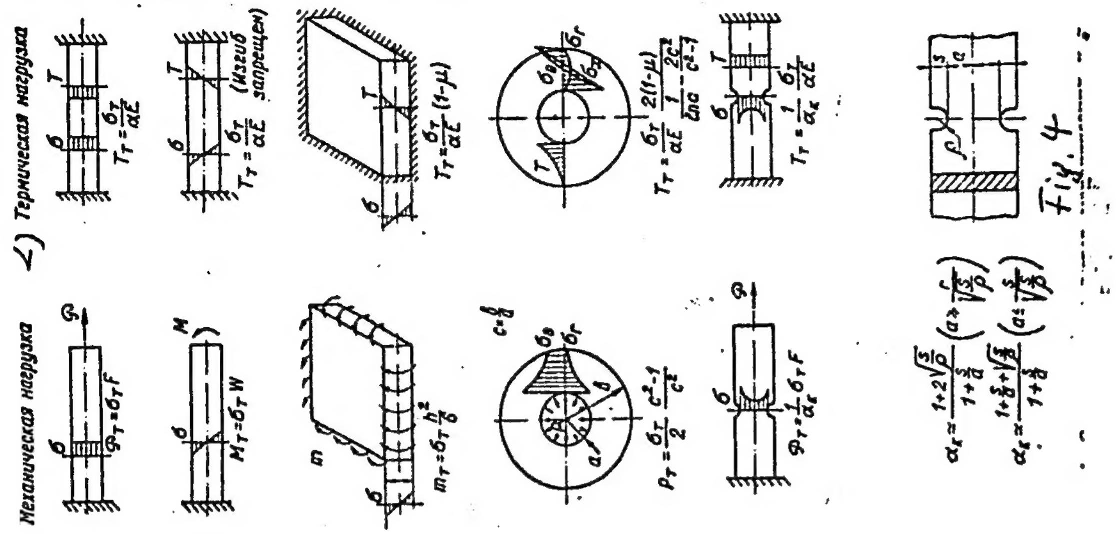

Fig. 4

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